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# The Profile Envision and Splicing Tool (PRESTO): Developing an Atmospheric Wind Analysis Tool for Space Launch Vehicles Using Python

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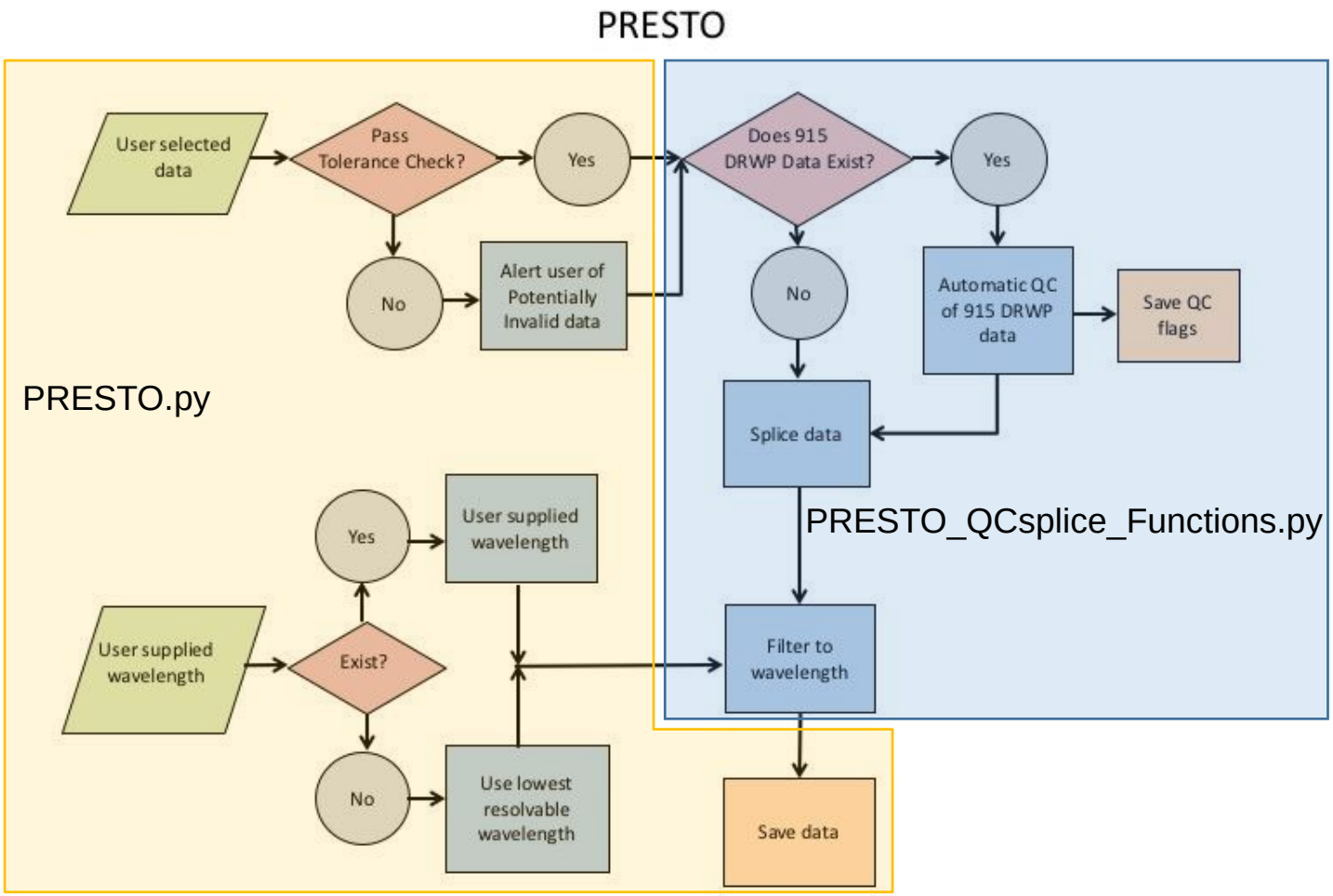
# Background

- Tropospheric winds are important in the design and day-of-launch operations of space launch vehicles
  - Calculate loads
  - Develop trajectories
- Flight vehicle programs require a vertically complete profile with consistent effective vertical resolution (EVR)
- Multiple measurement systems exist at the Eastern Range (ER)
  - High Resolution (HR) and Low Resolution (LR) Balloons
  - Boundary Layer (915-MHz) and Tropospheric (48-MHz) Doppler radar wind profilers
- However each source provides different EVR, vertical coverage, and temporal coverage
- In order to create a vertically complete profile, aspects of each system must be captured

# PRESTO Introduction

- MSFC Natural Environments Branch has developed the Profile Envision and Splicing Tool (PRESTO) to produce vertically complete profiles from available sources
- Designed with cost, safety, flexibility, and usability in mind
  - PRESTO coded using Python 3
  - Has few dependencies
    - Numpy – array handling
    - Scipy – mathematical functions
    - Matplotlib – data visualization
    - Tkinter – create and execute the Graphical User Interface (GUI)
  - Consists of two modules
    - PRESTO.py – handles the GUI, arrangement of data, and visualization
    - PRESTO_Qcsplice_functions.py – handles the splicing and filtering of the data
  - PRESTO is operated through a GUI that allows the operator to select search dates and times, change file directories, change the filtering wavelength, and select profiles to view or splice
  - PRESTO contains fault tolerance/recovery processes
    - Alerts for any non-fatal errors and returns to a safe state
    - Protects against vulnerabilities such as incorrect date, time, and filter wavelength input, incorrect input files, etc. and stops the process
    - Contains realistic values check of input/output data
  - Capable of incorporating new measurement systems

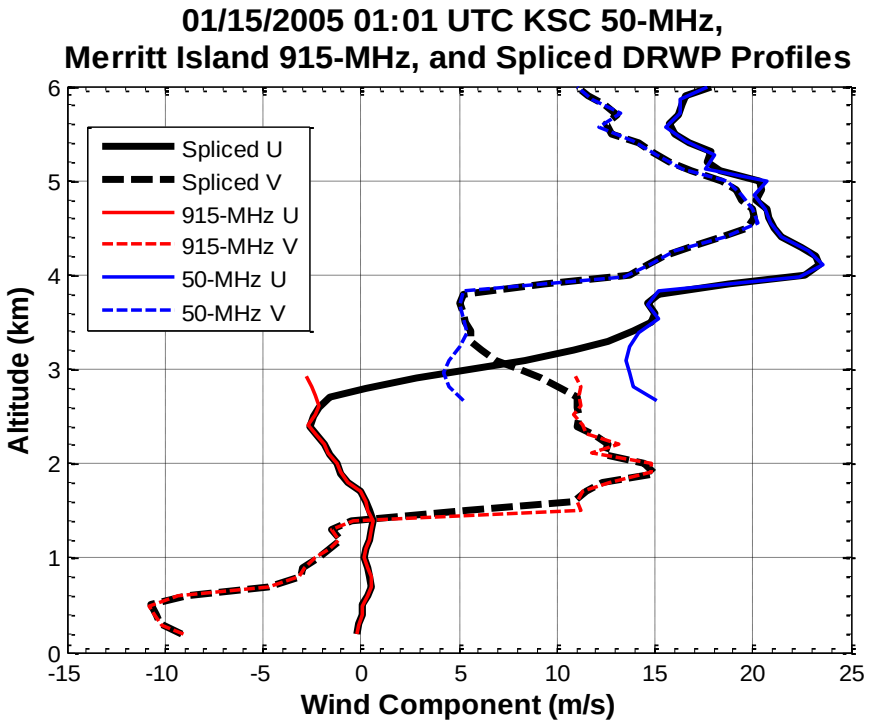
# PRESTO Design




- Overview of generating spliced profile with PRESTO

# Splicing & Filtering Procedures

- PRESTO can splice up to three profiles
- Profiles are fared using a Gaussian weighting scheme if overlap exists
- If there is no overlap between profiles being spliced, then the gap is interpolated using a linear interpolation scheme
- The spliced profile from measurement sources are then fared into a monthly mean profile above the highest measurement
- Finally a low-pass, six-pole, forward-backward Butterworth filter is applied to the spliced profile



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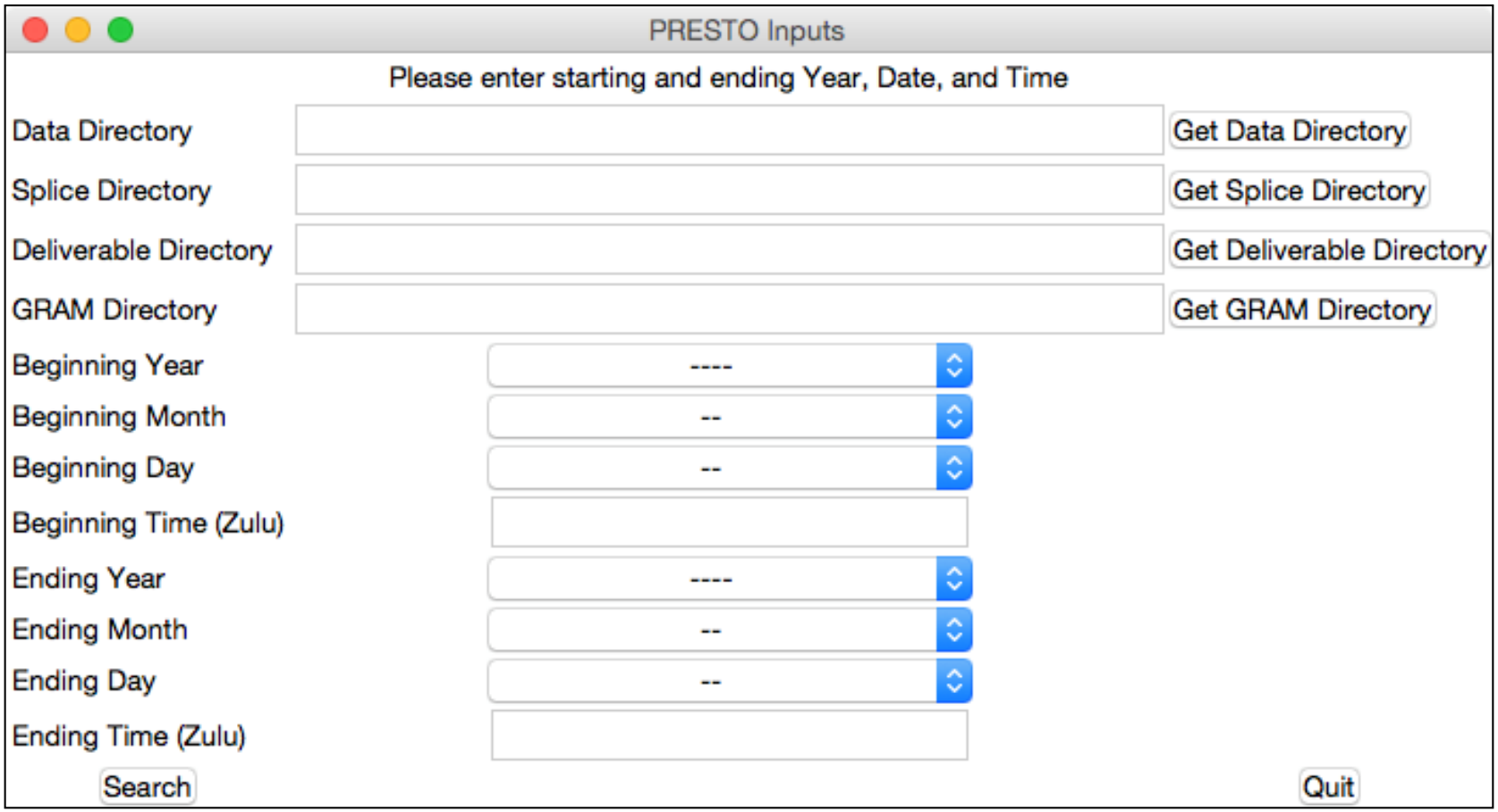
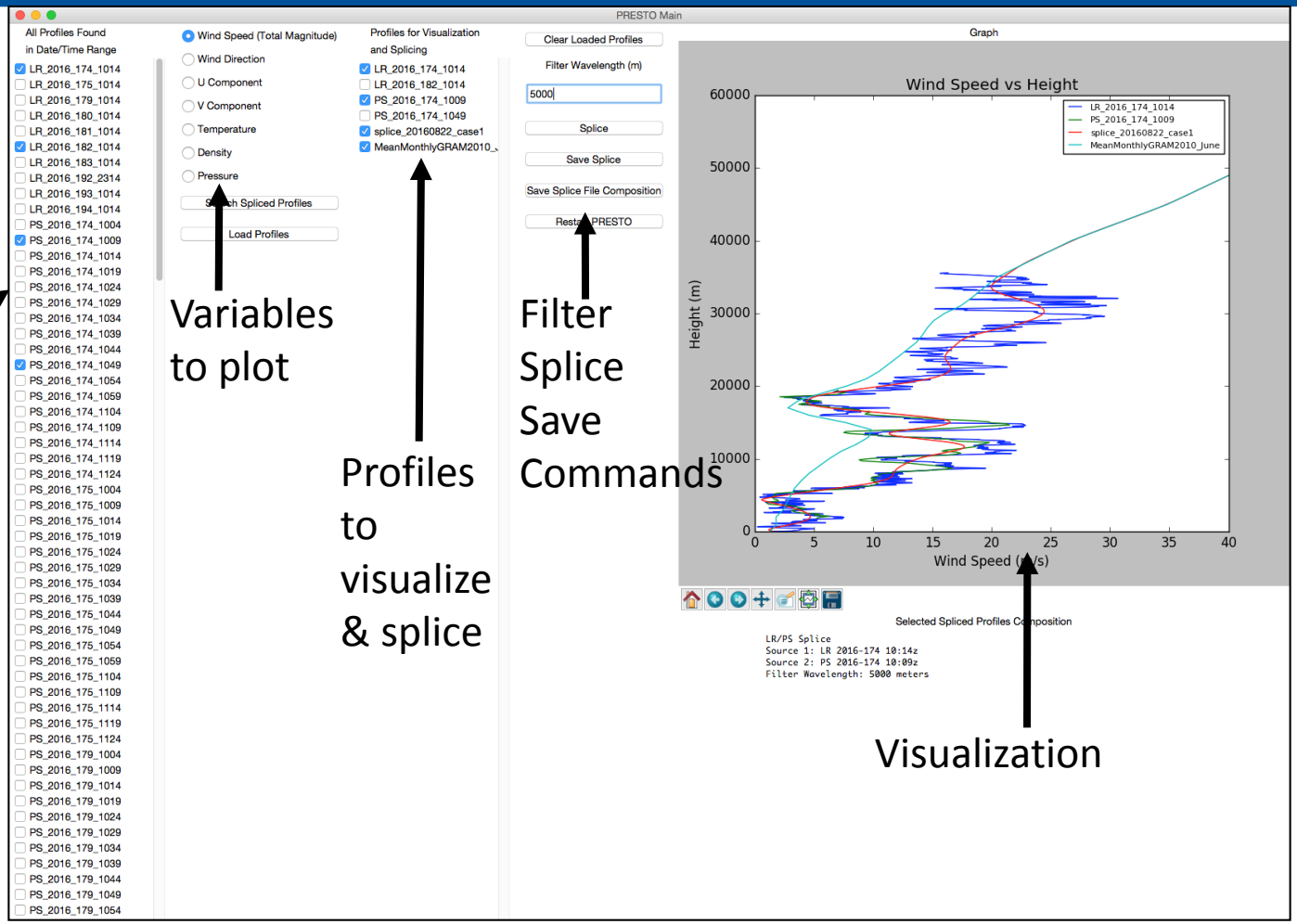



- Example of the screen where the operator enters the desired date range, initiates the search of the database, and loads the found files

# PRESTO Design




- The main window where the splicing and filtering are performed.

# Summary

- Launch vehicle programs require vertically complete atmospheric profiles
- Many systems at the ER to make the necessary measurements, but all have different EVR, vertical coverage, and temporal coverage
- MSFC Natural Environments Branch developed a tool to create a vertically complete profile from multiple inputs using Python
- Forward work
  - Finish Formal Testing
    - Acceptance Testing
    - End-to-End Testing
  - Formal Release

# Questions?

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